

HABITAT SELECTION AND BEHAVIOR OF NESTING BALD EAGLES IN LOUISIANA

JAMES O. HARRIS, PHILLIP J. ZWANK AND JOSEPH A. DUGONI

ABSTRACT.—Habitat selection and behavior of nesting Bald Eagles (*Haliaeetus leucocephalus*) in Louisiana were investigated from December 1977 to May 1980. Twenty-nine nests that were thought to represent 12 occupied and four unoccupied breeding areas were surveyed. Most (93%, N = 27) nests were in old, large, baldcypress trees (*Taxodium distichum*), with much of the surrounding area in marsh or swamp. Behavior of nesting eagles was observed at three nests. Over 75% of activity occurred at the nest, over marsh and over swamp. Over 60% of activity consisted of perching or straight-line flight.

Currently about 29 pairs of Bald Eagles (*Haliaeetus leucocephalus*) nest in Louisiana (unpubl. data, 1985-86 nesting season, Fred Bagley, U.S. Fish and Wildl. Serv., Jackson, MS). The bird is now listed as an uncommon resident (Lowery 1974), but during the early 1900s it was reportedly a common resident over most of Louisiana, particularly near southern water bodies (Bailey 1919), and on the Mississippi River delta (Allen 1936).

Within the nesting range, drainage, channelization, exploitation of baldcypress/tupelo-gum (*Nyssa aquatica*) forest type, marshland conversion to agriculture, and oil, gas, industrial, and residential development continues. The effects of these activities on nesting Bald Eagles in Louisiana are not documented but may be detrimental (Snow 1973). Information on nesting habitat selection and behavior may be of assistance in reducing adverse effects. The objectives of this study were to describe nesting habitat and behavior of selected nesting pairs of Bald Eagles in Louisiana.

STUDY AREA

The study was conducted in the coastal region of south-central and southeastern Louisiana (Fig. 1). The area is at low elevation and consists primarily of permanently to seasonally flooded, second-growth baldcypress/tupelo-gum swamps and backwater areas with associated marsh, bayous, canals, ponds, lakes, and rivers. Plant species vary with drainage patterns, elevation, and biotic and edaphic factors and are described by Chabreck (1972).

METHODS

Nest Site Characterization. Terminology follows that given in Swenson et al. (1986). A breeding area was an area containing ≥ 1 nest within the range of one mated pair of birds. An occupied nest was one at which a mated pair of eagles was present at the nest, had repaired the nest, and/or had laid eggs. An active nest was an occupied nest in which eggs were laid. An alternate nest was an

unoccupied nest within the breeding area of one pair of eagles.

All known breeding areas (unpubl. data, U.S. Fish and Wildl. Serv.) in the study area were visited to determine nest tree species. Nest tree diameter, condition (living or dead), and height were recorded.

Concentric circles of 1.6-, 3.2-, and 4.8-km radii were drawn around known breeding areas on 15-min series U.S. Geological Survey topographical maps. Recent (1978) color infrared photographs were used to update the topographical maps relative to any habitat alterations that occurred since the date of printing. Habitats that could be interpreted from infrared photographs were open water lakes, marsh ponds, bayous, pipeline canals, cypress-tupelo swamps, marshes, pipeline rights-of-way, and industrial/residential developments. The first four types were considered aquatic habitats, while the remainder were considered terrestrial habitats, even though swamps, marshes, and pipeline rights-of-way may be permanently or seasonally flooded. Sizes of habitat types existing within specified radii around each nest were determined by using a planimeter.

Percent cover of the habitat types within 1.6-, 3.2-, and 4.8-km radii of nests and percent cover of terrestrial and aquatic habitats were compared between breeding areas using unpaired t-Tests (Steele and Torrie 1980).

Observation of Nesting Pairs. Three Bald Eagle breeding areas that had been active during the 1976-77 nesting season (South Bayou Chene, Paradis and White Kitchen) were chosen for observation of eagle behavior during the 1977-78 and 1978-79 nesting seasons. The habitat around Bayou Chene nest was a mix of marsh and swamp. The White Kitchen nest was located in an area dominated by marsh and swamp with little open water. The Paradis nest was situated on the edge of a baldcypress/tupelo island with few mature trees, and was surrounded by water and marsh. The Bayou Chene and Paradis breeding areas each contained two nests, and the White Kitchen area had one.

Prior to observation, the three breeding areas were reconnoitered to locate nests, to ground-truth habitat information from photographs and to determine approximate eagle activity patterns. At each site, an observation blind was constructed prior to arrival of nesting pairs. Blinds were constructed within 100 m of the nest to afford a good view of daily eagle activity with binoculars and spotting

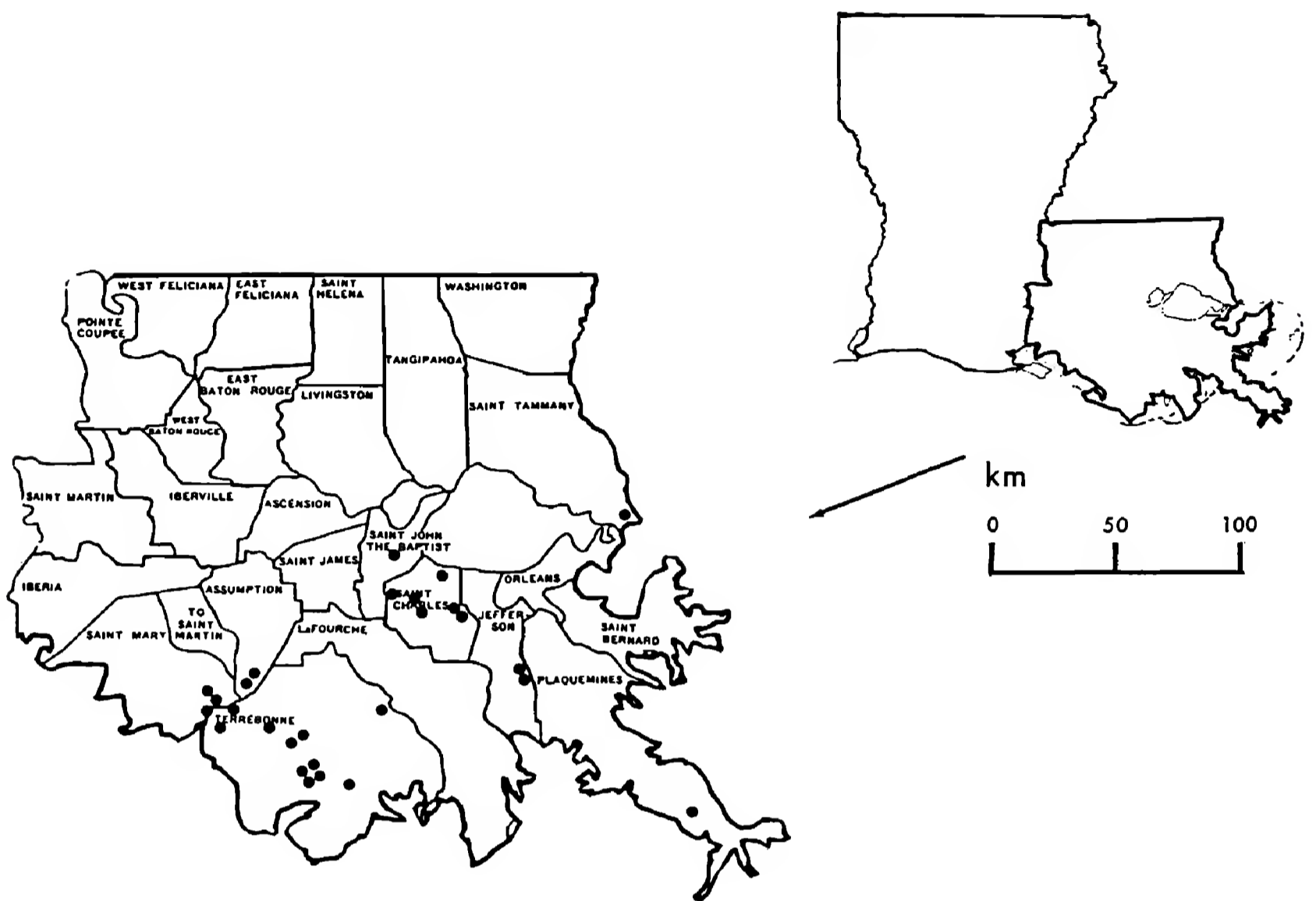


Figure 1. Known locations of Bald Eagle nests in southcentral and southeastern Louisiana in 1976-77.

scopes. Observations were made at least 2x/wk from the time eagles arrived in September-October until young fledged in April-May. Observations were made from dawn to dusk except when fog or severe weather conditions made observations impossible. Data recorded included number of eagles sighted, location, time of initial observation and time when lost from sight, habitat in which observation occurred, and eagle activity. Observations were primarily of adult eagles. Duration of a sighting was initiated when an eagle was first observed over any habitat and terminated when habitat and/or activity changed or when the eagle was lost from view.

Eagle activities were recorded as occurring at the nest or over marsh, swamp, lake, open water, bayou or canal. Activities were categorized as foraging, soaring, combined foraging and soaring, straight-line flight, aggressive behavior, perching, courtship, and other. The other category included feeding, preening, and other less frequently observed activities.

RESULTS

Nest Site Characterization. During the study, 29 nests thought to represent 12 occupied and four unoccupied breeding areas were surveyed (Fig. 1).

We classified six (20%) as alternate nests. Twenty-seven of 29 nests in this study were situated in bald-cypress trees (24 in live trees and three in dead trees). The remaining two nests were in dead live-oaks (*Quercus virginiana*).

All nests but one were in dominant or co-dominant trees, often on a habitat interface adjacent to aquatic habitats. Typically, nest trees had broken tops and an enlarged uppermost whorl of branches that provided a platform for the nest structure.

Incidence of nest loss, particularly due to storms and lightning, was substantial. Approximately 11% of occupied nests were destroyed annually during the course of this study.

Habitats near active nests were highly variable, with swamp being the only type found in the immediate vicinity of all nests (Table 1). Swamp also provided a large percentage of habitat within 1.6-, 3.2-, and 4.8-km of all active nests (Table 1). Swamp also provided a large percentage of habitat within the sampled areas. Marsh was the other major hab-

Table 1. Mean and (range) in percent of coverage by eight habitat types within 1.6, 3.2, and 4.8 km of 23 occupied Bald Eagle nests in southcentral and southeastern Louisiana, June 1979.

RADIUS (KM)	TERRESTRIAL				TOTAL
	SWAMP	MARSH	PIPELINE RIGHT-OF-WAY	DEVELOP- MENT	
1.6	36.8 (2.0-93.2)	36.8 (0-71.3)	1.0 (0-4.9)	6.4 (0-32.2)	80.5 (25.8-98.1)
3.2	30.9 (4.1-89.9)	37.2 (0-73.0)	0.6 (0-3.8)	8.3 (0-31.0)	76.9 (31.2-96.0)
4.8	29.9 (2.7-80.9)	35.4 (0-62.8)	0.5 (0-3.4)	8.6 (0-26.9)	74.5 (29.4-96.9)
RADIUS (KM)	AQUATIC				TOTAL
	LAKE	MARSH POND	BAYOU	PIPELINE CANAL	
1.6	8.2 (0-37.8)	6.5 (0-74.2)	3.5 (0-11.4)	1.3 (0-5.0)	19.5 (1.9-74.2)
3.2	11.2 (0-38.6)	7.2 (0-62.0)	4.1 (0-22.5)	1.4 (0-9.2)	23.1 (4.0-68.8)
4.8	13.0 (0-34.8)	7.8 (0-49.8)	3.4 (0.2-14.6)	1.3 (0-4.8)	25.5 (3.1-70.6)

itat type at all distances measured. None of the aquatic habitat types contributed more than 10%. Coverage by developments ranged from 0.0-32.3% within 1.6-km of the nests and changed little as distance increased from the nest.

The relative percentages of habitats did not change ($P > 0.10$) as distance from the nest increased from 1.6- to 3.2- and 4.8-km. Additionally, the relative percent of aquatic and terrestrial habitats remained consistent around nests (Table 1), and this relationship was similar for all distances measured ($P > 0.10$).

Observation of Nesting Pairs. During 2000 hr of observations during two nesting seasons, 1745 sightings of adult Bald Eagles were made, classified, and recorded. Overall, 69.8% of the sightings occurred in the Bayou Chene breeding area, 19.8% at Paradis, and 10.4% at White Kitchen.

Analyzed by location, 28% of the observed activity occurred at the nest, 27% over marsh, and 28% over swamp (Table 2). All percentages dealing with eagle activity refer to percent total time observed. Perching and other were the primary activities at the nest. Eagle activities over marsh consisted mostly of foraging and straight-line flight. Perching and

straight-line flight were the major activities over swamp.

Of observed activity by behavior type, 32% consisted of straight-line flight and 32% perching (Table 2). Straight-line flight was usually observed over swamp, marsh, or in flights to and from the nest. Perching was usually observed in trees in the swamp near the nest or at the nest. Foraging for food and soaring each accounted for approximately 10% of activity. Approximately 1% of activity was courtship and aggressive behavior. Courtship and soaring usually occurred over aquatic, open habitats.

Large parts of the breeding areas were not visible to the observer at any time. Therefore it was impossible to accurately estimate what habitat was being used at all times. Within the area visible to the observer, eagles of the Bayou Chene nest were observed the majority of the time (43%) over marsh habitat (Table 3). Around this nest, nearly 1/2 (43%) of the available habitat within a 4.8 km radius was marsh. Although little of the visible activity occurred over swamp (<0.1%), 20% of the habitat within 4.8 km of the active nest was swamp. Activity around the White Kitchen nest was greatest over the swamp habitat (67%), which makes up about 1/2 (47%) of the available habitat within a 4.8 km ra-

Table 2. Mean percentage of Bald Eagle activities that occurred over various habitat types near three nests in Louisiana during the 1977-78 and 1978-79 nesting periods.

ACTIVITY	NEST	MARSH	SWAMP	LAKES AND OPEN WATER	BAYOUS/ CANALS	TOTAL
Straight-line flight	5.1	10.1	11.1	1.1	4.1	31.5
Perching	11.7	5.0	14.5	0.2	0.1	31.5
Soaring	0.4	3.0	0.7	2.9	4.1	11.1
Foraging	0.0	7.5	0.0	0.8	1.2	9.5
Foraging and soaring	0.0	0.8	0.0	0.8	0.7	2.3
Aggressive behavior	0.1	0.3	0.0	0.1	0.3	0.8
Courtship	0.0	0.2	0.0	0.2	0.0	0.4
Other	<u>11.1</u>	<u>0.3</u>	<u>1.3</u>	<u>0.0</u>	<u>0.1</u>	<u>12.8</u>
Total	28.4	27.2	27.6	6.1	10.6	99.9

dius. Eagle activity around the Paradis nest was concentrated at the nest. However, visibility of surrounding habitats from the observation location was limited. About 36% of the activity of the Paradis eagles occurred over swamp, which had a coverage of $> \frac{1}{2}$ of the habitat within 4.8 km.

DISCUSSION

Nest Site Characteristics. We found that Bald Eagles in southern Louisiana nest predominantly in old, dominant baldcypress trees along a habitat interface adjacent to aquatic habitat. Almost $\frac{1}{3}$ of the nest trees were either dead or had dead portions and, thus were highly susceptible to severe weather. Rebuilding of nests is common; however, nests lost during storms and hurricanes or other severe weather may limit productivity even after being repaired (Gerrard and Whitfield 1979; Swenson et al. 1986).

Our observations on reconstruction of nests in the original nest trees suggests that nesting eagles in southern Louisiana display a high degree of site tenacity. As nesting trees die and decay, suitable replacement trees must be available in the imme-

diately vicinity. Eagles often build a new nest within 1.6 km of a destroyed nest, usually within several hundred meters (Howell 1954). Data from our study indicate that most new nests are constructed within 100 m of the original nest site. The presence of perch trees in the vicinity of the nest is thought to be an important factor in nest-site selection (Sprunt et al. 1973; Shealy and Zwank 1981). Thus, preservation of mature baldcypress trees near eagle nests is essential in southern Louisiana.

Observation of Nesting Pairs. Nesting Bald Eagles in our study spent most of their time in straight-line flight over marsh or swamp, or perched at the nest. Our findings in part agree with those of Shealy and Zwank (1981), who found that adult Bald Eagles spend the majority of time perching (45.5%) and that activities such as foraging and soaring most often occurred over open marsh. Our finding that a small portion of time was spent foraging for food, previously noted by Shealy and Zwank (1981), may imply that foods are abundant and accessible near Bald Eagle nests or that eagles foraged away from nests and out of view.

Table 3. Total minutes and (percent) of observed time spent over various habitat types by three nesting pairs of Bald Eagles, 1977-78 and 1978-79.

HABITAT TYPE	NEST DESIGNATION		
	SOUTH BAYOU CHENE	PARADIS	WHITE KITCHEN
Marsh	4568 (42.9)	280 (4.0)	265 (5.7)
Swamp	2 (0.1)	2500 (35.9)	3085 (66.8)
Nest site	2876 (27.0)	4121 (59.1)	1269 (27.5)
Bayou and canal	1889 (17.7)	0 (0.0)	0 (0.0)
Lakes and open water	1314 (12.3)	70 (1.0)	0 (0.0)

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Address of first and second authors: Louisiana Cooperative Fish and Wildlife Research Unit, Louisiana State University, Baton Rouge, LA 70803. Address of third author: School of Forestry, Wildlife, and Fisheries, Louisiana State University, Baton Rouge, LA 70803.

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